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China's Future in Peaceful Use of Military Technology

93FE0566A Beijing ZHONGGUO KEJI LUNTAN [FORUM ON SCIENCE AND TECHNOLOGY IN CHINA] in Chinese No 2, Mar 93 pp 11-13

[Article by Jin Zhude [6855 2612 1795] of the Chinese Association on Peaceful Use of Military Technology]

[Text] The two world wars in this century left unerasable spiritual trauma, but for a time some people in the world still believed that only war can solve the conflict and disagreement between countries and nations. Some also believe the myth that only military force might help them reach their goals. With this kind of thinking during the several decades after World War II, some countries delved into war preparation and devoted all they had to the development of various new weapons and the defense industry. At the peak of the arms race between the United States and the Soviet Union, world peace was threatened.

In this period, different countries had their own motivation and goals. Most of the countries tried to protect the interest of their people and only a few had expansion in mind. But the end result was to devote an enormous amount of human and material resources to the development and manufacturing of military equipment and the situation lasted for almost half a century. As history unfolds, more and more people have realized that war is no panacea for resolving conflicts. Unchecked development of weapons not only exhausts a country's wealth but also seriously threatens the survival of the human race. With that realization, people began to learn negotiation and dialogue and to discuss arms reduction and peace. This has been a great advance for humankind.

Because of the special historical background and national situation, China was ahead of the times in the move toward peace. In the late 1970's, the Third Plenum of the 11th Party Central Committee of the Chinese Communist Party made objective evaluation of the international situation. Based on this evaluation, it was proposed that the national focus should be shifted to the modernization of industry, agriculture, science and technology, and defense. The content of China's defense modernization was different from what it used to be; it was to protect world peace and domestic construction rather than preparing for world war. This concept was also contained in the defense industry development policy of "military and civilian combination" proposed in 1979. Under this policy, as many resources as possible were put into the construction of the national economy after meeting the needs of defense construction. Granted that we should still ensure the technical level of defense construction and improve the quality of weapons and equipment, but the quantity of facilities and personnel will become much smaller than before. As a result, the resources "left over" for civilian use have increased substantially. In this sense, the "military-civilian combination" consists of two aspects: to preserve the military and to convert to civilian use. The latter is what we usually refer to as "military-to-civilian conversion."

In practice the military-to-civilian conversion effort consists of the following parts. First, to improve the productivity of existing military industries and to convert to the production of civilian goods. Second, to convert some military installations and equipment to civilian use. Third, to gradually declassify, develop, and convert the defense technologies cumulated in previous research, testing, production and applications. Relatively speaking, the conversion of some defense installations and equipment to civilian use is easier than the conversion of the military industries. One difficulty is that with a sudden reduction of orders, military industrial workers face a survival problem. The second difficulty is to help the defense industry find a marketable product, which is not an easy job. Many military industries and enterprises will be fighting for survival, which some of the workers called "the second trail blazing." To date, although civilian products have topped 65 percent in defense industry output, only a few enterprises have found their niche in self-development. But on the other hand, the military industry has numerous science and technology (S&T) results and hundreds of thousands of first rate S&T personnel; it has its potential. As the conversion deepens, this potential will blossom and make the conversion a success.

As stated above, countries in the world have in the past concentrated their talented personnel and strength on military technology and used their results on weapons. As a result, conversion will be the most important force in the rest of this century for moving science and technology forward. In China defense science and technology and the defense industry employ more than 300,000 technical people and have the most advanced research results in every major field including mechanical and chemical engineering, electronics, optics, nuclear technology and space technology. This represents an enormous wealth for China resulting in great expenses in human, financial, and material resources. This has led some people to say that military-to-civilian conversion is like a ready-to-explode "atomic bomb" in China's national economic construction. If the power of the "bomb" can be effectively released, it will be an incredible force in China's national economy and social development. Because of this, China has made "military-civilian combination" one of the important components of its national development strategies; the significance is profound. Expectations for the conversion are very high.

In China's space industry, more civilian satellites will be launched in the future and development of the satellites themselves will also be stressed. To satisfy domestic needs and to move into the international market, we shall develop satellites and associated systems for resources, weather, environment and ecology, agriculture, rescue, communication, navigation, and scientific experiments. In addition, we shall also make use of the technology advantages in space industry to develop

technologies closely related to the national economy, such as digitally-controlled devices, industrial automation and process control, technology systems, communication equipment, solar energy application, medical equipment, and packaging machines.

In addition to the development of various civil transport aircraft, China's space industry will also develop new textile machines, pharmaceutical manufacturing equipment, land-use aircraft, and wind power generators. International standards are expected to be reached in a number of these technologies and products.

China's nuclear industry, while developing nuclear power, shall continue to do research in thermal nuclear reactors, and devote large efforts in such areas as application of radiation technology in agriculture, food, medicine, inspection, environmental protection and scientific experiment. In addition, special techniques such as extraction will also be applied broadly in the extraction and measurement of trace elements.

In the area of shipbuilding industry, the technology will grow from the existing civilian ship production. Efforts will be put into the development of new high-performance ships such as catamarans, foil ships, and air-cushion vessels. These development efforts will enter the application stage in the near future and will reach international standards. In addition to shipbuilding, the shipbuilding industry will also enter technology areas of in-well measurement and control systems for oil prospecting, various energy machineries, and ultrasonic technology.

The weapons industry has found some new directions in its recent conversion effort, including vehicles, engineering mechanics, chemical materials and pharmaceuticals. In the future civilian opto-electronics will be an important area for development. The future is bright for lasers, infrared, microlight, night-vision, and opto-electronics conversion technologies.

Electronics industry is an area in which military and civilian uses are difficult to separate. However, China's electronics industry was based on the development of military electronics. Although most of the electronics technologies have been converted to civilian use in recent years, some of the cutting-edge technologies in electronics are still used in defense first. Conversions in electronics technologies include LSI (large-scale integrated) circuits, computers, electronic monitoring systems, communication systems, networks, and software development.

The conversion from military to civilian use is by no means a simple matter. In the civilian sector, the commercialization and industrialization of technological results are complex and formidable processes, as is well known. The military-to-civilian conversion also involves declassification, resolution and recombination; its degree of difficulty is naturally even greater. It touches upon issues of administrative management, technology, and legal problems such as property rights and recognition of transfer. For general technology transfer (commercialization and industrialization) there are usually four steps. The first step is technology development or the transfer from a laboratory environment to the application environment and giving the technology practical value. The second step is product development. This involves combining the results from one or more technologies to form a new product. The third step is the development of the productive capability. This involves the building of production lines for new products. The fourth step is market development. This involves sales, transportation, after-sales service, and customer feedback. When the technology transfer is from military to civilian use, each step must be preceded by a "separation" stage. In this stage the technology is separated from the weapons system, declassified, property right owners established, and transferred. The development of weapons technology for civilian use also involves the adaptability problem from a weapons system environment to a civilian environment.

Today the major limiting factors in China's peaceful use of defense technology are a shortage of funds for development, a weak marketing ability and a low management standard. We shall first discuss the problem of development funds. Of the defense technology results, with the exception of some industrial results, most of the new, high-tech results are in the possession of various research institutes and laboratories. Today's defense research institutes are relatively independent. Their income comes mainly from operating expenses allocated by the state every year and research expenses that come with the assigned research task. Since the number of defense research assignments has dropped in recent years, many research institutes are relying on the 2,000 yuan of operating expenses per person per year, which is not enough for these institutes to survive on. Although they have in possession many valuable research results, these results are undeveloped and cannot bring in direct economic income. If they wish to capitalize on their research results, they must first invest a sum of money to develop the results. Although many civilian enterprises are in urgent need of technology, they are unaware of what technologies are available at the defense institutes, or not sure about the application prospects of these technologies, and therefore unwilling to risk venture capital. This has impeded technology transfer. Furthermore, some technology requires large investment and development time, which is beyond the means of ordinary medium or small enterprises. Ironically, these medium and small enterprises are the very ones in need of the technology. Large enterprises in China are mostly constrained by operating mechanisms and are not ready for technology transfer. In such a situation, the transfer of research results from the defense institutes is wrought with difficulties. To transfer the technology, an institute must carry out the development themselves and the only source of funds seems to be loans. A loan is not necessarily a feasible option. A few years ago the loans provided by the central and local governments were

relatively small and short-termed. Many research institutes were unable to pay them off in time. That has also impeded the transfer of technology. However, the situation has changed somewhat recently. As reform deepened, the cooperation between research concerns and enterprises has increased. They develop the results together and share the profits together. By combining the technology, the manufacturing and the business into one series of consecutive steps, they have completed the four steps of commercialization and industrialization described above. Experience shows that this is a viable approach, but there is still an acute shortage of development capital. Because the ratios of required investment for the first three steps are 1:10:100, financial resources remain a difficult problem. We will now discuss the problem of marketing. Due to the long practice of planned economy, our enterprises generally lack marketing ability, especially defense enterprises. Without a sense of market need, many of our enterprises develop products blindly. The developed products are either not needed or lose the domestic market to others due to the lack of a sales network, not to mention an international market. This situation is caused by inadequate business and sales strategy and networks. Granted defense enterprises have some strengths in technology management and production management, but they have intrinsic weakness in business management. This is because in the past the products of defense enterprises were produced and distributed according to a plan and there was no need for marketing. The weak business management is a fatal flaw. The initial passiveness and incompatibility of defense enterprises in technology transfer had their roots in the low level of business management.

In order to solve these problems, we are taking a number of approaches, among them, the most important measure is to improve the market awareness of the defense enterprises. Through policy, we are trying to lead the defense enterprises and research units toward the market and let them experience market competition. We should encourage them to develop their advantages and make up their inadequacies. The defense enterprises need to change from passive to active and release the enormous power they possess in as short a time as possible so that they may contribute to the people and the country and blaze a new trail for themselves.

Wang Daohan on S&T Cooperation Across Taiwan Strait

93FE0614B Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 29 Apr 93 p 5

[Article by reporter Liu Jiansheng [0491 1696 3932]]

[Text] Singapore, 27 Apr (XINHUA)—Chairman of the Association for Relations Across the Taiwan Straits (ARATS), Wang Daohan, in his first talk on 27 April with Chairman of the Strait Exchange Foundation (SEF), Koo Chenfu, raised questions concerning cultural and S&T exchanges across the Taiwan straits.

These questions included: I. Industrial S&T cooperation and exchange, and the need to work out the three following aspects: First, actively engage scientists and technicians in mutual investigations in various fields of study through visits and normal exchange of S&T materials and publications. Study and establish a bilateral S&T and patent information system. Second, give careful consideration to bilateral means of unifying and standardizing S&T terms and nomenclatures, intellectual property rights protection, and establish models for research exchange and cooperation. Third, in areas where both sides have interest in industrial S&T, select cooperative projects, looking especially at exchanges between S&T parks and zones, and further promote bilateral cooperation in high-tech industries. Suggested projects are: 1. seven projects in the field of optoelectronics that can be the first cooperative project are: a) optoelectronic components and elements; liquid crystal displays, heat-sensitive printing heads, light-sensitive OPC DROM, charge-coupled devices (CCD). b) optoelectronic products: facsimile equipment, laser printers (radial printers), optoelectronic medical instruments, laser equipment and laser processing equipment. 2. The computer field: cooperation in computer external facilities, intelligent computers, high-performance computers, and establishment of computation technology R&D centers can be considered. 3. The machinery field: wherever cooperation is possible in basic miscellaneous parts, high-speed trains, numerically controlled lathes, shipbuilding. 4. Telecommunications: mobile telephones and standardization of telecommunications equipment. 5. Astronautics: commercializing the mainland's high-temperature ceramics, temperature control technologies with future prospects. 6. Biotechnology and pharmaceuticals: the mainland is rich in Chinese herbal medicines, and Taiwan is more advanced in new pharmaceuticals development; there is great potential for cooperation in raw materials and preparation of pharmaceuticals.

II. Bilateral protection of intellectual property rights. The mainland welcomes compatriots in Taiwan to come to the mainland to register trademarks, apply for patents, and carry out copyright trade and publication exchange, and has laws to protect Taiwan compatriots' intellectual property rights, and a series of regulations that have been specially formulated for these matters, including administrative and judicial procedures, and an agent system that has a set of protective procedures and facilitating measures. It is understood that there have been repeated examples of Taiwan enterprises pirating or infringing mainland authorship rights and well-known mainland trademarks, and agent organizations have not been able to go directly to Taiwan to conduct exchange or investigations. The mainland side is glad to see the close cooperation in intellectual property rights, and it is hoped that Taiwan will offer genuine guarantees and facilitate these economic and cultural interchanges. The Association has been authorized to carry out talks on bilateral intellectual property rights issues.

III. Bilateral youth exchange. It is accepted that there should be bilateral youth exchange. On the one hand, the

mainland warmly welcomes visits by Taiwan youths, and hopes that besides high- and middle-school students, youths and children will have opportunity as well. On the other hand, it is hoped that mainland youths and children will have the opportunity ot go to Taiwan. Political issues should not stand in the way of such visits. Organization of exchanges of youths and children should be handled through appropriate bilateral civilian organizations on both sides, and make the most of that bridge that exists between both sides.

IV. Bilateral press exchange. The initiation of bilateral exchange of press has been a happy event. The mainland Association agrees that these talks should include the question of bilateral press exchange, and the mainland's concerns about its rights, and offers the following suggestions: 1. Taiwan should as soon as possible and as far as possible simplify procedures for mainland reporters' requests to visit Taiwan. 2. The Taiwan agencies that make up the credentials for press visits should take out the language that is unacceptable to the mainland press. The Association suggests for mainland reporters coming to Taiwan, that Taiwan authorize pertinent civilian groups to be the agents for handling of relevant procedures. 3. In order to encourage bilateral mutual exchanges and contacts among people involved in the news business, the Association intends to make separate contacts, or to organize leading mainland news officials and senior reporter teams to visit Taiwan this year, and at the same time invite Taiwan's leading media officials to visit the mainland. It is hoped that both organizations will offer assistance in these matters.

PRC Seeking Cooperation With Taiwan in Space Technology

93P60249A Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 11 Mar 93 p 5

[Summary] It has been learned that in 1997 Taiwan plans to spend $500 million on launching its first experimental satellite for the purposes of solar-earth research, ocean temperature photography, and space telecommunications. Qi Faren [2058 4099 6514], director of the Chinese Academy of Space Technology (CAST), wants to cooperate with Taiwan in such areas as design assessment of satellites, consultation, and manufacturing of satellite subsystems and parts. CAST is a main research institute under the Ministry of Aeronautics and Astronautics conducting satellite research and manufacturing. The satellite Taiwan is planning to launch will weigh 400 kg and will have a 300-km perigee, 900-km apogee orbit.

Bank of China Group Provides $75 Million Loan for 1994 Launch of Asia-Pacific No. 1 Satellite

93P60264A Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 1 Jun 93 p 3

[Article by Yang Lianghua [2799 5328 0553]: "Bank of China Group Provides US$75 Million Loan for Next Year's Launch of 'Asia-Pacific No. 1' Satellite"]

[Summary] Beijing, 31 May—At a signing ceremony held today in the Great Hall of the People, the 11-member Bank of China Group formally provided a US$75 million favorable-terms loan to Asia-Pacific Communications Satellite Ltd. for the purchase of the HS376 communications satellite (known as "Asia-Pacific No. 1") made by the U.S. firm Hughes and for satellite launch service via a CGWIC-made Long March 3 rocket. It is understood that this satellite has 24 C-band transponders and has a beam that covers all major countries of the Asia-Pacific region. The satellite is to be launched in mid-1994 from the China Xichang Satellite Launch Center and formally put into commercial service in late August [1994].

Precision Orbit Determination Using Three-Frequency Two-Way Ranging and Range-Rate Measurement System

93FE0541A Beijing ZHONGGUO KONGJIAN KEXUE JISHU [CHINESE SPACE SCIENCE AND TECHNOLOGY] in Chinese Vol 13 No 1, 25 Feb 93 pp 65-70

[Article by Tai Ping [1132 5493] of the Beijing Institute of Spacecraft System Engineering]

[Text] **Abstract**

Improving tracking accuracy is one of the key issues of satellite tracking systems which has been the focus of intensive research for many years. In this paper, the preliminary design concept of a microwave precision tracking system is presented; such a system can be used for precision satellite orbit determination.

1. Study of Satellite Tracking Techniques

For many years, a number of different countries have devoted significant efforts to the study of satellite tracking techniques with the intention of improving tracking accuracy and further developing the theory of tracking.

Currently, the following ranging and range-rate measurement techniques are used in a tracking system.

(1) Laser ranging technique. This technique provides high measurement accuracy, but it is sensitive to weather conditions and therefore does not have all-weather capability.

(2) Ultra-shortwave Doppler system. This technique is technologically quite mature, but it cannot meet the ranging accuracy requirement.

(3) GPS/navigation positioning technique. This technique provides precision orbit determination using GPS measurements; it is a technique that warrants further study.

(4) VLBI (Very Long Baseline Interferometer). This technique provides high positioning accuracy, but its implementation is very expensive and has certain unique requirements; consequently, its applications are limited.

Because of the limitations of the above tracking techniques, efforts were initiated in the early 1980's to study microwave precision ranging systems in order to meet the accuracy ranging requirements imposed by various scientific fields such as geophysics, oceanography, wide-area surveillance and astronomy.

2. Precision Ranging and Range-Rate Equipment

2.1 System Configuration and Basic Principle

The overall configuration of the precision ranging and range-rate equipment (PRARE) system is shown in Figure 1. In addition to the capability of making high-precision range and range-rate measurements, this system can also transmit data between the satellite and the ground station. The main components of the system include the X-band and S-band tracking subsystem (MTSS) onboard the satellite and the ground tracking subsystem (MTSG).

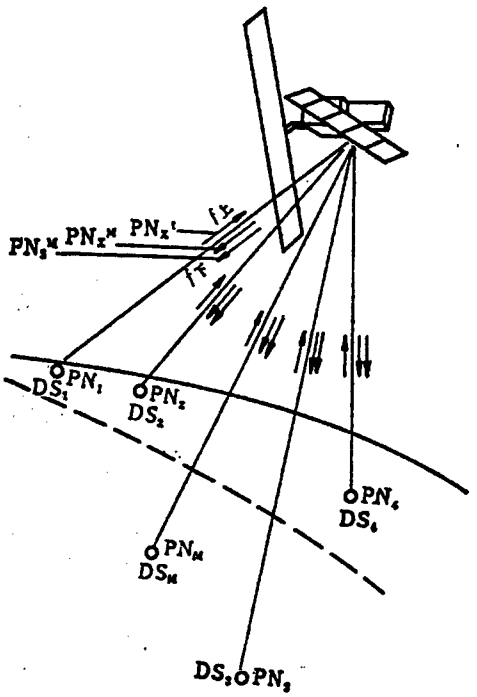

Figure 1. PRARE System Configuration

The tracking signal transmitted by the onboard MTSS is transponded by the ground equipment and again received and measured by the onboard equipment. A block diagram of the microwave ranging and range-rate measurement system is shown in Figure 2.

The PRARE system uses two frequencies for two-way range measurement; it uses another auxiliary downlink frequency to correct for ionospheric effects. In addition, two coherent downlink frequencies can be used to provide range-rate measurement. The basic ranging technique is based on the digital correlation method, and the ranging signal is a phase-modulated pseudo-random (PN) code; it is also possible to use analog method for range measurement. The following discussion will be focused primarily on the digital ranging technique. The technique used in the PRARE system for range-rate measurement is similar to the currently used ultra-shortwave dual-frequency technique.

2.2 Key Technical Parameters of the PRARE System

(1) Operating frequencies: 7 GHz, 8 GHz and 2 GHz.

(2) Weight of the MTSS equipment: less than 12 kg (including antenna weight).

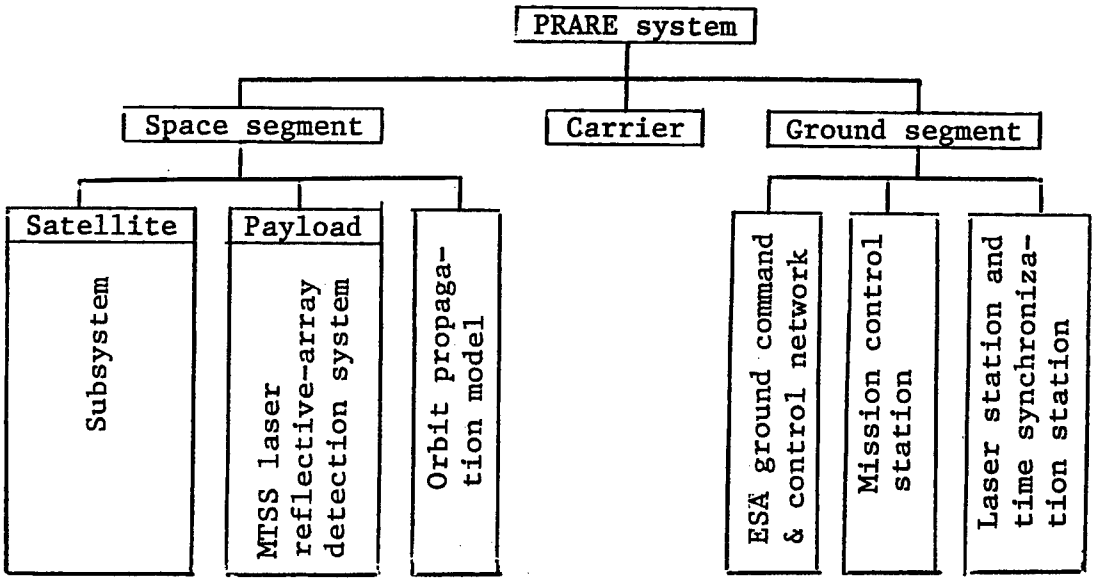

Figure 2. Block Diagram of Microwave Ranging and Range-Rate Measurement System

(3) Ranging accuracy: 10 cm.

(4) Orbit height: 778 km.

(5) Residual error due to ionospheric refraction: less than 1 cm.

Comparison of the PRARE system with other ranging systems shows that it has many advantages such as simplicity, low cost, and operator-free ground equipment; it is a highly advanced tracking system with automatic range and range-rate measurement capability.

2.3 System Concept

(1) Frequency Selection

The PRARE system operates in the microwave band; its frequency selection is primarily based on considerations of atmospheric propagation effects which cause delays in signal transmission. The main effects of atmospheric propagation include: (a) effects of moisture-free air; (b) effects of water vapor; (c) effects of ionospheric refraction; (d) atmospheric absorption and other effects. The first two are effects caused by the troposphere.

Based on the above considerations, the optimum frequency for the PRARE system is selected to be in the range 5-10 GHz.

Specifically, the uplink frequency is chosen to be 7 GHz and the downlink frequency is chosen to be 8 GHz; also, an auxiliary 2 GHz downlink frequency is used for ionospheric correction.

(2) Design Requirements and Constraint Conditions

The overall configuration of the PRARE system is dictated by the following design requirements and constraint conditions: (a) frequency range is limited to 5-10 GHz; (b) effects of ionospheric refraction must be corrected using two downlink frequencies; (c) effects of troposphere must also be corrected; (d) instrument errors must be small; (e) construction cost and operational cost of the ground station must be kept as low as possible, and the design must be sufficiently simple to facilitate mass production; (f) multiple stations must be available to provide simultaneous ranging capability; (g) data transmission between the space segment and the ground station should be carried out by the data collection and data distribution subsystems onboard the satellite.

(3) Two-Way Ranging

Both digital and analog ranging systems are based on measuring the time delay of the signal between the transmitter and the receiver. Such ranging systems require two synchronized clocks in the space segment and the ground segment in order to ensure time synchronization between the satellite and the ground station. Therefore, any error in synchronization will directly affect ranging accuracy.

Synchronization error can be eliminated by two-way ranging. This involves re-transmitting the received signal from the receiving location, and then receiving it again at the transmitting location. The round-trip time delay of the two signals can be measured by direct comparison. This approach requires a single clock, and the accuracy requirement of this clock is greatly relaxed compared to the requirement for dual clocks.

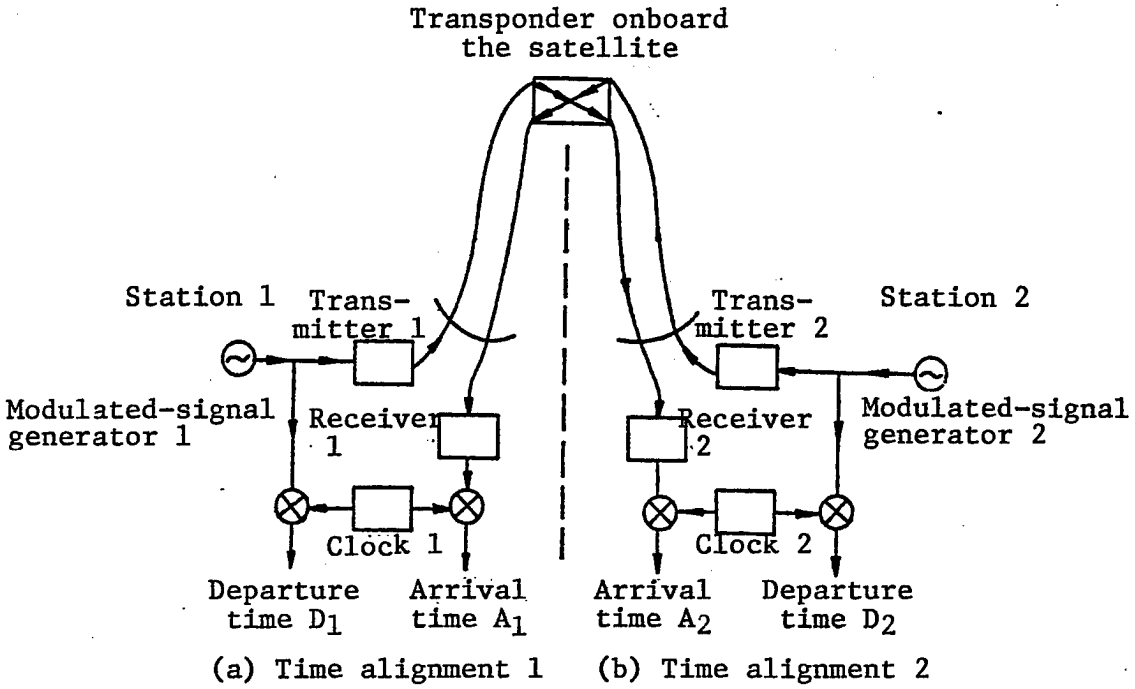

Figure 3. Time Alignment Schematic Diagram

In a satellite system using ground-based measurements, one satellite can serve as the reference point for multiple ground stations. To implement two-way ranging for such a system, it is advantageous to use a "space-to-ground-to-space" configuration. The space segment has the capability to perform the functions of verification and data collection, and to rapidly determine its position in space based on tracking data.

(4) Time Alignment

The PRARE system can perform time alignment between two widely separated points, as shown in Figure 3.

First, the departure time and arrival time of the two ranging signals are measured at the two ground stations; then the clock bias between the two stations can be calculated from the following equation:

$$\Delta = \tfrac{1}{2} (T_{A2} - T_{D1}) - \tfrac{1}{2} (T_{A1} - T_{D2}) \qquad (1)$$

where T_{A1} is the signal arrival time at the first station; T_{A2} is the signal arrival time at the second station; T_{D1} is the signal departure time at the first station; T_{D2} is the signal departure time at the second station.

The primary source of error is the difference in operating times between the two signals.

(5) Technical Approaches for Implementing Precision Ranging System

There are two technical approaches for implementing precision ranging:

(a) Analog ranging—this approach is based on the side-tone ranging system.

(b) Digital ranging—this approach is based on the digital correlation method; it can also be used in a navigation satellite system and in a deep-space network.

In this paper, only the second approach will be discussed.

The transmission circuit diagram of the digital ranging system is shown in Figure 4.

The digital technique presented here is called the "pseudo-random (or pseudo-noise) digital modulation technique"; it produces a bit stream similar to a random bit stream but with the following important differences: (a) this bit stream is repetitious; (b) its content is pre-determined; (c) while a true random bit stream has a continuous frequency spectrum, a PN sequence produces a discrete spectrum with good linear structure; the distance between the spectral lines is determined by the repetition rate of the PN sequence.

When the PN bit stream is modulated onto the RF carrier, the discrete characteristics of the spectrum are preserved. The signal-to-noise ratio of the received signal should be sufficient to ensure that range measurements can be performed by sharing the same frequency with

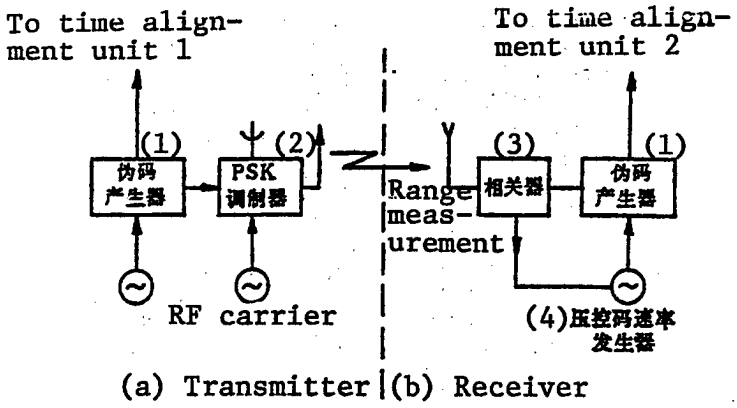

Figure 4. Transmission Circuit Diagram of a Digital Ranging System

Key: 1. Pseudo-random code generator; 2. PSK modulator; 3. Correlator; 4. Voltage-controlled chip rate generator

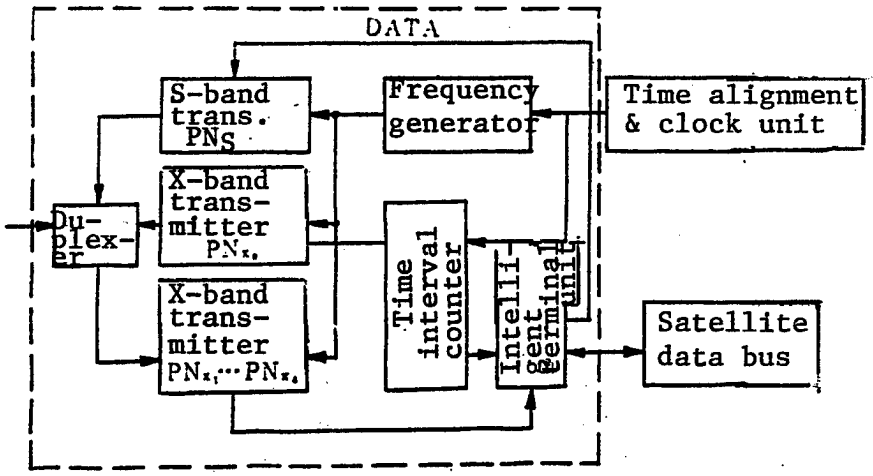

Figure 5. Block Diagram of MTSS

other users. For these users, the presence of the PN ranging signal can be treated as added wideband noise, and can be used to satisfy the requirement of the calculated limiting value of the power spectral density. It is possible for many ranging signals to share the same frequency, but these signals must use different PN codes.

The two pseudo-random code generators shown in Figure 4 produce identical pseudo-random codes. By phase-locking the incoming signal, the PN code generator in the receiver can determine the time delay between the two PN codes and hence the range value. The range resolution is determined by the chip rate of the PN code; selection of the chip rate should be compatible with the channel noise power density and the measurement equipment. The range ambiguity is determined by the length of the transmitted message; improvement of the range ambiguity can be achieved by modulating the signal.

A block diagram of the onboard MTSS is shown in Figure 5.

It consists of an X-band transmitter, an S-band transmitter, a duplexer, and X-band receiver, a time interval counter and an intelligent terminal unit. The X-band receiver has four coherent receivers which are used to process the four uplink signals at the code divider; the S-band transmitter is used to transmit PN signals and data to the ground stations. The intelligent terminal unit serves as an interface with the data management system.

In standard operation, a PN code (PN_{x0}) with a chip rate of 10 M chips/s and a length of 10,000 chips is generated to produce a 1 bit/s timing signal; the signal is phase-modulated in the range between 8,450 MHz and 8,500 MHz. The bandwidth of the transmitted signal is 20

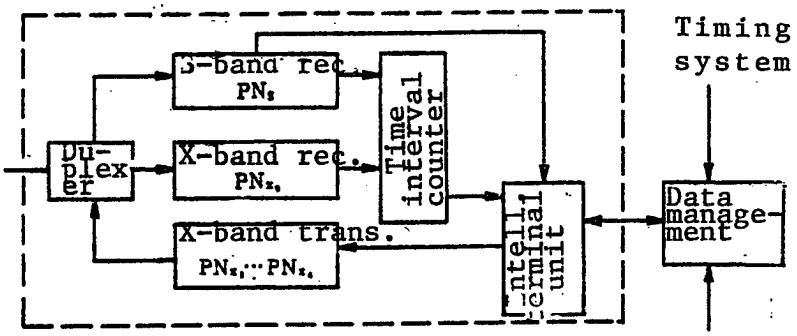

Figure 6. Structure of the Ground MTSG

MHz. At the same time, an S-band PN signal (PN_s) with a length of 1,000 chips and a rate of 1 M chips/s is also generated.

In the PRARE system, a 10-MHz PN_{x0} code sequence is first modulated onto the 8-GHz downlink carrier; after being recovered by the ground transponder, it is then modulated onto the 7-GHz uplink carrier. In each transponder, the PN_{x0} code is converted into one of four orthogonal code sequences (PN_{x1}, ..., ..., PN_{x4}); these code elements can be received simultaneously by the satellite. In other words, although the ranging signals of the four transponders have different code elements, they can be received and measured simultaneously by the satellite. In addition, a 1-MHz PN sequence is also modulated onto a 2-GHz downlink carrier; the fact that these two sequences are coherent can be used to correct for the effects of ionospheric refraction on the ground. The parameter values used for ionospheric and tropospheric corrections as well as other back-up data are stored onboard the satellite. These data can be transmitted to the ground station via the downlink carrier for centralized processing.

The ratio between the uplink and downlink frequencies of the X-band signals is 749/880. The signals received by the satellite are sent to the four coherent receivers where carrier search, code acquisition, and extraction of the ranging signal and the doppler signal are carried. The functions of carrier search and code acquisition are controlled by the intelligent terminal unit (ITU). The range and doppler signals are sent to the time interval counter for processing.

The structure of the ground MTSG is shown in Figure 6.

The MTSG receives the X-band and S-band signals and measures the time delays which are then used in the range calculation.

In the MTSG, the PN_{x0} sequence is converted into four orthogonal sequences: PN_{x1}, ..., ..., PN_{x4}. These signals together with other data are then transmitted to the satellite.

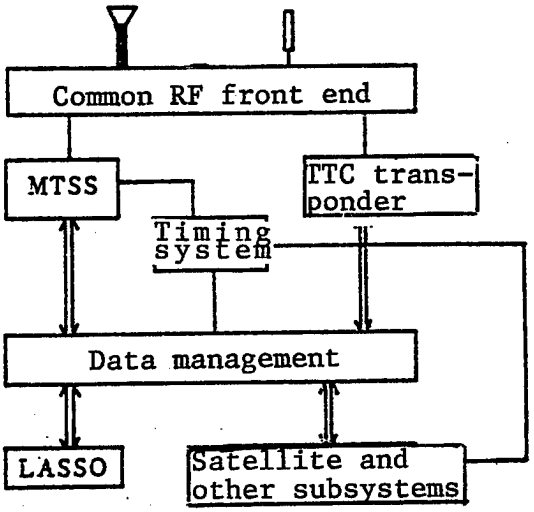

Figure 7. Data Interfaces Onboard the Satellite

The interfaces between the onboard data management subsystem and the telemetry and control subsystem and other subsystems are shown in Figure 7.

The data management subsystem is used to process the following data streams:

(a) Data stream to the payload (MTSS and LASSO);

(b) Data streams to and from other satellite subsystems;

(c) Data streams to and from the telemetry unit.

It can be seen from Figure 7 that the satellite has two antennas: one is an earth-pointing antenna used for X-band and S-band tracking and for data transmission to the ESA ground station; the other is an omni-directional rod antenna used for remote control and telemetry.

References

1. Walls, F. L., Stein, S. R., Instrum. Meas. IEEE Trans., 1978 (In Press).

2. Stein, S. R., Turneaure, J. P., In Future Trends in Superconductive Electronics. Hugh C. Wolfe, ed., New York: AIP Conference Proceedings, 1978 (44): 204.

PLA Air Force's Flight Control Simulation System Detailed

93FE0634A Beijing GUOJI HANGKONG [INTERNATIONAL AVIATION] in Chinese Apr 93 pp 56-57

[Article by Xing Baoan [6717 1405 1344]]

[Text] The flight control simulation system developed by the PLA Air Force is a hybrid simulation system specifically designed to simulate three types of flight dynamics systems: target aircraft, attack aircraft and air-to-air missile. It is a large-scale system whose main components include the flight control system and the fire control system. It can simulate the physical behavior of the aircraft control system, the missile control system, and the infrared target motion. It is used to perform a variety of functions including on-line measurement, identification, tuning and trouble-shooting for in-air operation of equipment onboard the aircraft and the missile.

The flight control system can operate either in the manual mode or the automatic mode. It can simulate three types of flight vehicles with a total of 15 degrees of freedom: 6 degrees of freedom for the attack aircraft, 3 degrees of freedom for the target aircraft (assumed to be a point target in linear motion in a rectangular coordinate system), and 6 degrees of freedom for the air-to-air missile. The system has four rotating platforms: two 3-degree-of-freedom platforms are used to simulate the angular motion of the attack aircraft and the missile, one 2-degree-of-freedom platform is used to simulate the linear motion of the target aircraft, and one single-degree-of-freedom platform is used to simulate the acceleration of the attack aircraft about its own three axes. The linear motions of the attack aircraft and the missile are controlled by other control systems.

System Components

The flight control simulation system has four main components: the flight control system, the fire control system, the linear motion system and the computer system.

The **flight control system** consists of the flight attitude simulator, the angle-of-attack simulator, the total pressure simulator, the linear acceleration simulator, the autopilot, the simulated aircraft, the test recorder and the associated computer system.

The computer-controlled flight attitude simulator can simulate changes in the roll, pitch and yaw angles of an aircraft or a helicopter during actual flight. The attitude sensors located in the autopilot provide the signals of various rotational motions of the aircraft.

The angle-of-attack simulator is designed to simulate changes in the angle of attack of the aircraft, and drives the angle-of-attack sensors to provide the appropriate signals for the autopilot.

The total pressure simulator is used to simulate changes in the static pressure and the total pressure acting on the aircraft during flight; it provides the pressure readings to the altitude sensor, the velocity sensor and the Mach number sensor for velocity and altitude simulation.

The linear acceleration simulator is designed to produce varying centripetal acceleration, and to simulate changes in the tangential and normal accelerations along the flight trajectory in order to provide the required linear acceleration reading for the acceleration sensor in the flight controller.

The autopilot used is the actual system to be tested by the flight control simulation system.

The computer system is a hybrid analog-digital system used to perform the following functions: controlling the operation of all the simulators, simulating the aerodynamic and dynamic characteristics of the aircraft, obtaining real-time solutions to the mathematical models and processing the data during the simulation process.

The turning motion of the rudder of the real aircraft is directly reflected on the simulated aircraft.

The **fire control system** can simulate the autopilot and the control system of the aircraft as well as the fuse operation and the static and dynamic characteristics of the air-to-air missile. It can also be used to study the laws of motion of the aircraft and the missile.

The 3-degree-of-freedom **linear motion simulation system** consists of an infrared radiation source, an ellipsoidal reflective screen, and a 2-degree-of-freedom rotating platform with a gold-plated reflecting mirror. The intersection of the two axes of the rotating platform coincides with one of the two foci of the ellipsoidal screen. Thus, regardless of the target position, the signal from the infrared source can always be reflected by the gold-plated mirror onto the ellipsoidal reflective screen; the signal is then reflected by the reflective screen to the other focal point of the ellipsoid, which coincides with the point of intersection of the axes of the 3-degree-of-freedom platform of the steering unit of the missile. By moving the light speckle of the infrared signal, it is possible to simulate the motion of the pitch and yaw angles of the target; the intensity of the infrared signal and the size of the speckle reflect the target distance. The 2-degree-of-freedom rotating platform and the infrared

radiation source are controlled by the computer-generated control signal based on the specified target motion (e.g., level flight, climb, glide, circling and somersault, etc.) and by the signals which reflect changes in the relative angle, range and altitude difference between the attack aircraft or the missile and the target. The former is pre-determined and the latter changes automatically with the changing scenario. For an infrared-guided close-range missile, its motion is synchronous with that of an attack aircraft prior to launch, i.e., the 3-degree-of-freedom rotating platform containing the autopilot of the aircraft is in synchronous motion with the platform containing the steering unit of the missile, and the computer provides a solution for the course of attack. Once the missile is launched, the attack aircraft is removed from the scene, and only the platform containing the missile steering unit remains to track the infrared speckle on the ellipsoidal screen until the target is hit or disappears.

Key Technical Specifications

Range of simulated altitudes: 0 to 25,000 m; range of air speeds: 0 to 2,500 km/hr; range of Mach number: 0 to 2.5; steady-state errors for the above parameters: less than 4 percent.

Range of simulated aircraft yaw, pitch and roll angles: +/-17° with a steady-state error of 10' and pass bands of 3.5 Hz, 6 Hz and 8 Hz respectively.

Range of simulated aircraft angle-of-attack: -7° to 33°30' with a steady-state error of 10' and a pass band of 5 Hz.

Range of simulated missile yaw, pitch and roll angles: +/-15° with a steady-state error of 10° and a pass band of 8 Hz.

Range of simulated target distance: 100 to 10,000 m; range of simulated linear acceleration: +/-10 g with a steady-state error of less than 0.5 percent.

Research in Radar Adaptive Array Processing Technology Described

93P60253A Chengdu DIANZI KEJI DAXUE XUEBAO [JOURNAL OF UNIVERSITY OF ELECTRONIC SCIENCE AND TECHNOLOGY OF CHINA] in Chinese Vol 22 No 2, Apr 93 p 221

[Article by Bian Xuan [0593 1357]: "Introduction to Research Achievement: Radar Adaptive Array Processing Technology"]

[Summary] Adaptive signal processing techniques are critical to the development of new-generation radar models. The present project, consisting of research on radar adaptive array processing technology and on radar adaptive filtering techniques, includes the first proposal worldwide of a semi-infinite-dimension quadratic optimized robust adaptive array processing algorithm, plus theoretical analysis and initial results obtained from a linear FM-CW X-band four-element array experimental system. This system, with a bandwidth of 500 MHz, incorporates digital beamforming (DBF) and adaptive space-domain interference suppression techniques. The new algorithm provides an interference suppression of 38 dB. Also, the project includes the first use of a systolic processing algorithm for radar adaptive MTI [moving target indication] and the first realization of an experimental system using a general-purpose microcomputer chip with hardware multiplier providing a three-node signal-to-noise improvement factor exceeding 18 dB for an interference greater than 2 percent of bandwidth.

New Anti-Cancer Compound Synthesized

93P60250D Beijing JIAN KANG BAO in Chinese 23 Apr 93 p 1

[Article by Wang Haiyun [3769 3189 0061]]

[Summary] With the assistance of Beijing Medical University, Shanghai Medical University, the Chinese Academy of Medical Sciences, and the CAS (Chinese Academy of Sciences) Institute of Geography, researcher Tang Jiajun [0781 1367 7486] of the CAS Research Center for Ecological Environment extracted an anti-cancer substance called Kalajiao (a polysaccharide gelatin) from seaweed, and prepared a compound containing selenium called Aoxikang (selenic ester polysaccharide). Research results indicate that Aoxikang [1159 8970 1660] can be used for treating cardiovascular diseases, and because of its anti-mutation function, it can be used as a supplementary drug during chemotherapy and radiation therapy processes for cancer treatment. Moreover, the immunity-enhancing function of Aoxikang makes the compound useful for severe hepatitis, rheumatoid arthritis, lupus erythematosus, and epidemic hemorrhagic fever treatments.

PRC Report on Anti-Biological Warfare R&D

93P60251A Beijing CHINESE GOVERNMENT REPORTS in Chinese 1 Aug 92 pp 1-20

[Excerpt] The following PRC report has been made according to the requirements for exchange of seven measures of confidence declared at the Third Review Conference of the Treaty's Signatory States of the "Treaty on the Prohibition of Development, Production and Stockpiling of Bacteriological (Organism) and Toxin Weapons, and on Their Total Destruction" held in Geneva on 9-27 September 1991.

1. A Report Table for Data Exchange Using "No Data To Declare" or "No New Data To Declare" Categories

Measure	No data to declare	No new data to declare
A, Part 1		x
A, Part 2 (I)		
A, Part 2 (II)		
A' Part 2 (III)		
B (I)		
B (II)	x	
C		
D		
E		
F		
G		
Date: 15 March 1992		
Signatory State: People's Republic of China		

Measure of Confidence "A" Part 2, Exchange Data Pertaining to Defensive Biological Warfare R&D Program

Part 2 (I): China has national defensive biological warfare R&D program

Part 2 (II):

1. In 1991, activities involved were diagnosis of HFRS (hemorrhagic fever renal syndrome), hepatitis and lyme disease; research on aeromicrobial detection, dysentery recombinant vaccine, viral disease treatment, anti-malarial drugs, and disinfectant research and development (R&D).

2. Funding: The Ministry of Defense provided funds of 1.8 million yuan ($360,000) per annum for the program.

3. No contract had been awarded to industries, academic or other non-military organizations.

4. None.

5. None.

6. Ministry of Defense, Medical Department of the General Logistics Department, Academy of Military Medical Sciences, Institute of Microbiology and Epidemiology

7. See table in Part (III)

Part (III): Facilities

1. Name of facility: Institute of Microbiology and Epidemiology

2. Location: 23-A, Qilizhuang Road, Fengtai, Beijing, China 100071

3. Area of laboratory (square meters):

BL-2	330
BL-3	118
BL-4	0
Total area	4,820

4. Organizational structure:

1) Total staff	246
2) Personnel classification	
Military	11
Civilian	235
3) Personnel category	
Scientist	106
Engineer	2
Technician	118
Administrative and logistic	20

4) Major fields of scientists/engineers: Medicine, Microbiology, Epidemiology, Aeromicrobiology, Entomology, Zoology, Pharmacy, Pharmacology and Toxicology, Organic Chemistry, Biochemistry, Electronics Automation, Optical Instrument, etc.

5) No contractors

6) Funding 1.8 million yuan ($360,000) per annum

7) Rate of funding

Research	50 percent
Development	50 percent
Test and assessment	0 percent

8) All research results done in the organization were openly published

9) All research papers and reports published in 1991 follows (see pp 15-22)

5. Areas covered in research papers published in 1991: Diagnosis of hemorrhagic fever renal syndrome (HFRS), hepatitis and lyme disease; research on aeromicrobial detection, dysentery recombinant vaccine, viral treatment, anti-malarial drugs and disinfectant R&D, etc. In addition to aeromicrobial detection no open-air microbial aerosol research had been conducted.

Measure of Confidence "B," Exchange Data Pertaining to Similar Incidents Caused by Outbreak of Epidemic Diseases and Toxins

(I) Background Data of Outbreak of Epidemic Diseases (cases/year)

Disease	1988	1989	1990	1991
Plague	6	10	74	29
Cholera	7,265	5,599	639	205
Hepatitis	1,428,220	1,238,600	1,306,641	1,244,010
Dysentery	2,049,102	1,450,659	1,416,314	1,242,814
Typhoid fever & paratyphoid fever	151,062	118,619	114,673	110,257
AIDS	—	—	2	—
Epidemic encephalitis	21,189	14,537	9,885	7,087
Epidemic hemorrhagic fever	51,510	40,075	40,648	46,108
Rabies	4,838	5,156	3,520	1,883
Leptospirosis	34,676	33,807	28,830	28,068
Brucellosis	490	958	793	485
Anthrax	1,818	2,374	2,305	2,527
Typhus	3,812	4,997	3,471	3,712
Encephalitis B	25,123	17,993	38,062	23,618
Malaria	134,156	137,540	117,359	88,107
Dengue fever	—	—	376	752

Measure of Confidence "C"

Chinese scientists are always encouraged to openly publish their biological research results, see Measure of Confidence "A" Part 2 (III) for research papers published in 1991.

Measure of Confidence "D," Actively Promoting Cooperation

China encourages cooperation, contact and joint research with scientists of biological sciences who have direct relations with the treaty. The following international conferences will be held in China in 1992.

International Conference (1)

Name of conference: International Symposium on Antiviral Drugs

Sponsoring organization: Chinese Pharmaceutical Association

Date: April 1992

Location: Beijing, China

Major topic: Antiviral Drugs R&D

Conditions for participation: Presenting paper and fees paid

Contact point for information and registration: Chinese Pharmaceutical Association, 38-A North Lishi Road, Beijing, China 100037

International Conference (2)

Name of conference: International Symposium on Human Gene Therapy

Sponsoring organization: Beijing Science Association

Date: October 1992

Location: Beijing, China

Major topic: Human Gene Therapy

Conditions of participation: Presenting paper and fees paid

Contact point for information and registration: Beijing Science Association, 21, East Chang'an Road, Beijing, China 100005

International Conference (3)

Name of conference: Seventh International Congress for Culture Collections

Sponsoring organization: Institute of Microbiology, Chinese Academy of Sciences (CAS)

Date: October 1992

Location: Beijing, China

Major topic: Culture Collection and Diversity of Microorganisms

Conditions of Participation: Presenting paper and fees paid

Contact point for information and registration: CAS Institute of Microbiology, Zhongguancun, Haidianqu, Beijing, China 100080

International Conference (4)

Name of conference: 1992 Symposium on Polypeptides in China

Sponsoring organization: CAS Institute of Biochemistry

Date: September 1992

Location: Hangzhou City, Zhejiang Province, China

Major topic: Polypeptide Synthesis and Function Research

Conditions of Participation: Presenting paper and fees paid

Contact point for information and registration: CAS Institute of Biochemistry, 320, Yueyang Road, Shanghai, China 200031

International Conference (5)

Name of conference: International Symposium on the Structure and Function of Biological Macromolecules

Sponsoring organization: CAS Institute of Biophysics

Date: November 1992

Location: Wuxi City, Jiangsu Province, China

Conditions of participation: Presenting paper and fees paid

Contact point for information and registration: CAS Institute of Biophysics, Zhongguancun, Haidianqu, Beijing, China 100080

Measure of Confidence "E," Declaration of Law, Regulation, and Other Measures

Item involved	Legislation	Regulation	Other measure	Revision since last year
a. Development, production, stockpiling, acquiring or possessing microbiological agents mentioned in Article 1, or other microbiological agents or toxins, weapons, equipment, and means of transport	No	No	No	No
b. Exportation of microorganisms* and toxins	No	No	Yes	No
c. Importation of microorganisms* and toxins	No	No	Yes	No

* Those identified by the treaty as pathogenic organisms to human beings, animals, and plants.

Measure of Confidence "F," Past Activities on Offensive or Defense Biological Warfare R&D

1. Treaty effective date to China: 1984

2. Program for offensive biological warfare R&D in the past: None

3. Program for defensive biological warfare R&D in the past: China's defensive biological warfare program began in 1958. After 1984 strategy of the program was gradually shifted to focus on military common disease control R&D in peacetime. The program had been carried out by the Institute of Microbiology and Epidemiology. Major research projects conducted were: characteristics of organism and toxin agents; specimen collection; separation and identification of pathogens; quick diagnostic technique; applications of fluorescence technique, hemagglutination technique, ELISA (Enzyme-Linked Immuno-Sorbant Assay) technique; treatments of botulinal toxin poison and malaria; large-area sterilization; development and application of insecticides and rat exterminators and equipment; human live anthrax vaccine and botulinal toxoids. Pathogens and toxins involved were plasmodium, Salmonella typhi, Shigella dysenteriae, Bacillus anthracis, Bacillus pestis, Bacillus tularensis, encephalitis B virus, hepatitis viruses, equine encephalitis virus, forest encephalitis virus, dengue fever virus, epidemic hemorrhagic fever virus, Rickettsia tsutsugamushi, Q fever rickettsia (Rickettsia burneti Derrick), spotted fever rickettsia (Rickettsia conorii Brumpt), botulinal toxin, staphylococcus

enterotoxin, etc. In addition, research projects on variations of airborne microorganism in various conditions (time and environment), and medical insect classification and ecology were also conducted.

Measure of Confidence "G," Vaccine Producing Facilities

Vaccine Producing Facility (1)

Name of facility: National Vaccine and Serum Institute

Location: Sanjianfang (three-room house), Chaoyangqu, Beijing, China 100024

Types of disease covered: Production and research of biological products, such as bacterial strains, vaccines, toxoids, antisera, etc. (measles, poliomyelitis, encephalitis B, yellow fever and hepatitis B vaccines; BCG, whooping cough [pertussis], epidemic encephalitis, typhoid fever and paratyphoid fever bacterial vaccines; diphtheria anatoxin, tetanus toxoid and antitoxin, etc.).

Vaccine Producing Facility (2)

Name of facility: Shanghai Institute of Biological Products

Location: 1262, West Yan'an Road, Shanghai, China 200052

Types of disease covered: Production and research of biological products, such as bacterial strains, vaccines, toxoids, antisera, etc. (measles, encephalitis B, rabies and hepatitis B vaccines; epidemic encephalitis, typhoid fever and paratyphoid fever bacterial vaccines; tetanus toxoid and antitoxin, etc.).

Vaccine Producing Facility (3)

Name of facility: Lanzhou Institute of Biological Products

Location: 32, Yanchang Road, Lanzhou City, Gansu Province, China 730046

Types of disease covered: Production and research of biological products, such as bacterial strains, vaccines, toxoids, and antisera, etc. (measles and rabies vaccines; epidemic encephalitis, typhoid fever, paratyphoid fever, plague, brucellosis and anthrax bacterial vaccines; botulinal toxoid, tetanus toxoid and antitoxin, etc.).

Vaccine Producing Facility (4)

Name of facility: Changchun Institute of Biological Products

Location: 158, Xi'an Dajie, Changchun City, Jilin Province, China 130062

Types of disease covered: Production and research of biological products, such as bacterial strains, vaccines, toxoids, and antisera, etc. (measles, forest encephalitis, encephalitis B and rabies vaccines; BCG, whooping cough, typhoid fever and paratyphoid fever bacterial vaccines; diphtheria and tetanus toxoids and antitoxins, etc.).

Vaccine Producing Facility (5)

Name of facility: Wuhan Institute of Biological Products

Location: 6, Yanjiang Dadao, Wuchang City, Hubei Province, China 430060

Types of disease covered: Production and research of biological products, such as bacterial strains, vaccines, toxoids, and antisera, etc. (measles, encephalitis B and rabies vaccines; epidemic encephalitis, typhoid fever, paratyphoid fever, Vibrio cholerae and whooping cough bacterial vaccines; diphtheria and tetanus toxoids and antitoxins, etc.).

Vaccine Producing Facility (6)

Name of facility: Chengdu Institute of Biological Products

Location: East Baojiangqiao in the Suburbs of Chengdu City, Sichuan Province, China 610063

Types of disease covered: Production and research of biological products, such as bacterial strains, vaccines, toxoids, and antisera, etc. (measles, rabies and encephalitis B vaccines; epidemic encephalitis, whooping cough, BCG, typhoid fever, paratyphoid fever and leptospirosis bacterial vaccines; diphtheria and tetanus toxoids and antitoxins, etc.).

Vaccine Producing Facility (7)

Name of facility: Institute of Medical Biology, Chinese Academy of Medical Sciences

Location: Huahongdong, Kunming City, Yunnan Province, China 650107

Types of disease covered: Production and research of poliomyelitis vaccine and hepatitis A vaccine.

Research Papers Published in 1991

1. Kong Weiwei, et al., Medical insect specimen preparation and method for electron microscopy. Chinese Journal of Vector Biology and Vector Control, 1991: 2(3) supplementary issue: 60.

2. Deng Zhi, Measure and method for rats extermination. Chinese Public Health, 1991: 7(1): 167.

3. Deng Zhi, Harmfulness of rodents to human health. Chinese Public Health, 1991: 7(3): 131.

4. Ye Zongmao, Observation on effects of using several compounds and poisonous baits to attract houseflies. Chinese Journal of Vector Biology and Vector Control, 1991: 2(3) supplementary issue: 51.

5. Li Hong, Diversity of immunologic response to the membrane components of Shigella flexneri 2a on eight

strains of mouse. Chinese Journal of Microbiology and Immunology, 1991: 11(4): 216.

6. Li Jin, et al., Observation on effects of using wind tunneling ultraviolet air sterilizer in hospital wards. Chinese Journal of Sterilization, 1991: 8(1): 1.

7. Li Guofu, et al., Study on Naonuejia on the effectiveness of rodent malaria drugs, 15(2): 98.

8. Li Zhongping, et al., Study on detecting HFRS (hemorrhagic fever renal syndrome) virus using plaque formation method. Journal of Academy of Military Medical Sciences, 1991: 15(1): 19.

9. Li Qian, Location of multi-resistant gene of staphylococcus. Chinese Journal of Microbiology and Immunology, 1991: 11(1): 13.

10. Li Jingyun, et al., Distribution pattern of markers of HBV (hepatitis B virus) infection in village families. Journal of Academy of Military Medical Sciences, 1991: 15(3): 164.

11. Li Jingyun, et al., A follow-up study on HBV infection in a village of Beijing rural area. Chinese Journal of Epidemiology, 1991: 12(6): 321.

12. Li Jingyun, et al., Significance of distribution characteristics and epidemiology of HBcIgM in natural population. Journal of Academy of Military Medical Sciences, 1991: 15(1): 246.

13. Li Beisi, et al., Study on reproductive and nutritive rhythm, cycle and multiparous rate of Aedes albopictus. Medical Animal Control, 1991: 7(3): 174. [passage omitted]

Shigella Vaccine Research

93P60250A Beijing YICHUAN [HEREDITAS] in Chinese Vol 15 No 1, Jan 93 pp 17-19

[Article by Luo Zhenge [5012 2182 7245], Gao Jieying [7559 2638 5391], Kong Xiangying [1313 4382 5391], and Su Xin [5685 2450] of the Institute of Microbiology and Epidemiology, the Academy of Military Medical Sciences]

[Abstract] The purpose of this study is to develop a vaccine against Shigella sonnei. Researchers believe that live vaccine derived from a more invasive bacterial strain is more immunoprotective than those from less invasive ones. According to previous research reports, among several factors that determine the virulence of Shigella sonnei, the invasion-associated protein (Ipa) encoded with 180-230 kb large plasmid is the most significant decisive cluster of bacterial virulence. Although only a very small quantity of Ipa can be detected on the outer membrane of bacteria, it was found that Ipa has better immunogenicity than others. Therefore, Ipa could be a potential candidate for producing live bacterial vaccine against Shigella sonnei. In this study, researchers began with the construction of genomic library of invasion-associated large plasmids from Shigella sonnei. Then a recon (SH29) was cloned for the purpose of expressing the invasion-associated proteins Ipa A, B, C, D, by using cosmid PJB8 as a vector. In situ hybridization, Western blot and Southern blot analyses were conducted in this study. Sources of bacterial strains and plasmids: 1) Shigella sonnei S63 containing 180 kb plasmid and sereny test$^+$, and E. coli K-12 HB101 were provided by the institute. 2) pJB8 which is Ap^r and contains 5.4 kb cosmid was provided by Pasteur Research Institute in France. 3) pMYSH6503 which is Ap^r and contains 1 kb F fragment of F2a large plasmid came from Lanzhou Institute of Biological Products. 4) pHW626 which is Tc^{s}Cm^r and contains 4.1 kb ipa fragment of Shigella sonnei came from Japan National Institute of Health. 5) pRM17 which is Ap^r and contains 17 kb ipa fragment of Shigella flexneri 5b was provided by Tayler of Australia.

Expression of Shiga Toxin Subunit B

93P60250B Beijing ZHONGGUO KEXUE [SCIENCE IN CHINA-SERIES B] in Chinese Vol 23 No 1, Jan 93 pp 61-68

[Article by Su Guofu [5685 0948 1381] of the Institute of Biotechnology, Academy of Military Medical Sciences, Beijing, H. N. Brahmbhatt and K. N. Timmis of the National Research Center for Biotechnology, Germany]

[Abstract] Researchers are trying to find a new way to develop a preventive bacterial vaccine for Shigella dysenteriae 1. By directed mutation, researchers fused and inserted three parts (Stx17B, Stx27B, and StxB) of the shiga toxin subunit B into the outer membrane protein LamB of E. coli. Site of insertion BamH I was located between amino acids No. 153 and No. 154, and three fused proteins, LamB/Stx17B, LamB/Stx27B, and LamB/StxB were obtained. Indirect immunofluorescence and immuno electron microscopy analyses indicate that only LamB/Stx17B and LamB/Stx27B can be expressed on the cell surface of E. coli. LamB/StxB cannot be expressed and will also accumulate in the intercellular substance to poison the host cells. Sources of bacterial strains and plasmids: 1) E. coli K-12 DH5 (endA1, recA1, hsdR17, supE44, thi-1, gyrA96, relA1, F') were provided by Walker of Australia. 2) E. coli K-12 pop6510 (thr, leu, tonB, thi, lacY1, recA, dex5, metA, supE) and plasmid pAJC264 were provided by Professor Hofnung of the Pasteur Research Institute. 3) Plasmid pAJC264 carrying LamB gene and pgagemid pGCI including bacteriophage M13 were provided by Lorenzo of Spain. 4) Plasmid pJLA503 carrying C1857 gene was provided by McCarthy of Germany. 5) Hybrid plasmid pMGC001 carrying an intact shiga toxin gene was constructed in this laboratory. Figure 1 below shows scheme of constructing recombinant plasmids for this laboratory.

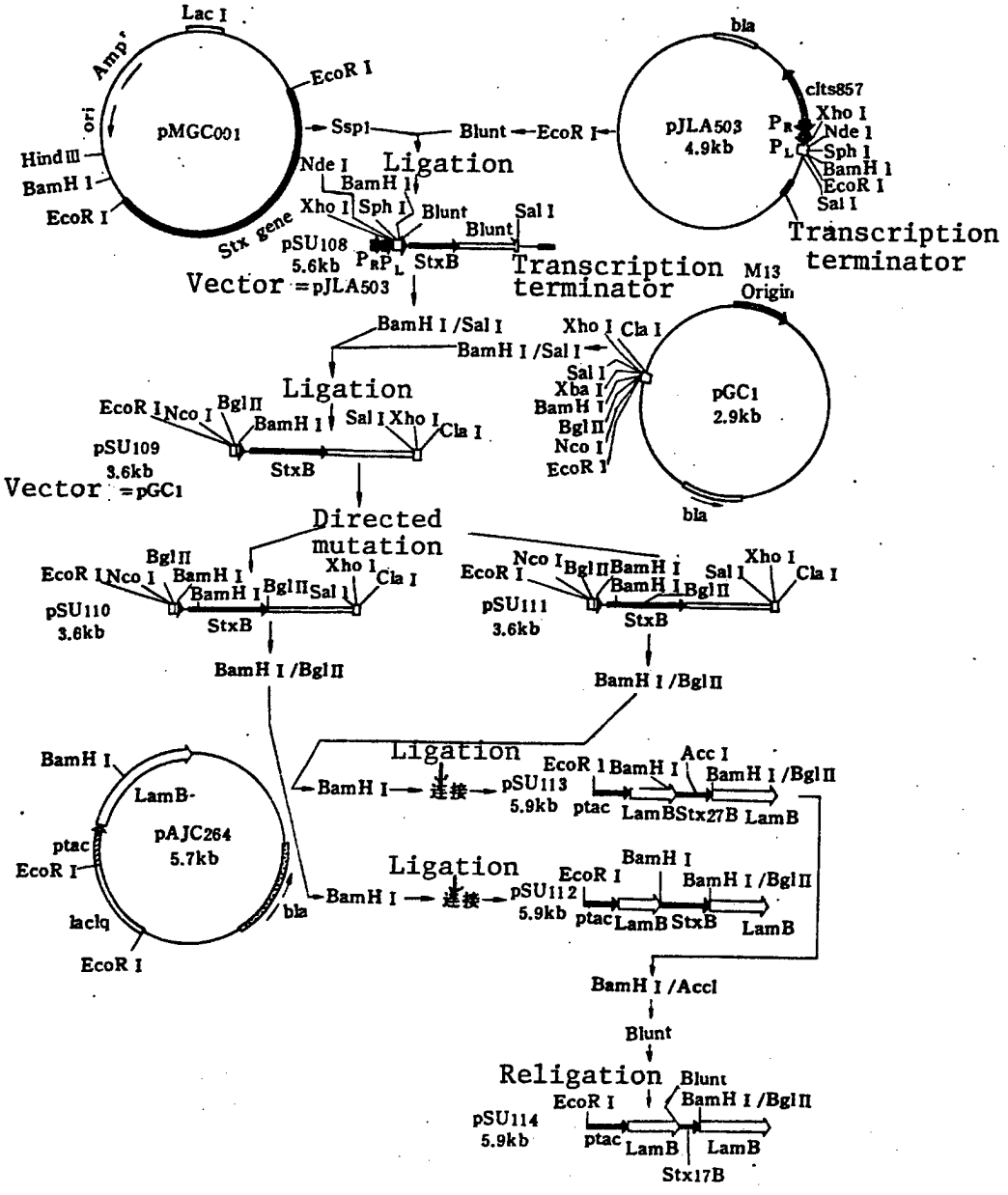
Lac I
Amp'
ori
EcoR I
pMGC001
Hind III
BamH I
EcoR I
Stx gene
Ssp1
Blunt
EcoR I
Nde I
Ligation
BamH I
Xho I
Sph I
Blunt
Sal I
Blunt
pSU108
5.6kb
PRPL
StxB
Vector =pJLA503
Transcription terminator
bla
pJLA503
4.9kb
clts857
PR
PL
Xho I
Nde I
Sph I
BamH I
EcoR I
Sal I
Transcription terminator
M13 Origin
BamH I /Sal I
BamH I /Sal I
Ligation
EcoR I Nco I BglII
BamH I
Sal I Xho I
Cla I
pSU109
3.6kb
StxB
Vector =pGC1
Xho I Cla I
Sal I
Xba I
BamH I
BglII
Nco I
EcoR I
pGC1
2.9kb
bla
Directed mutation
EcoR I Nco I BglII
BamH I
Xho I
Cla I
BamH I BglII Sal I
pSU110
3.6kb
StxB
BamH I /BglII
Nco I BglII BamH I
EcoR I
Sal I
Xho I
Cla I
BamH I BglII
pSU111
3.6kb
StxB
BamH I /BglII
BamH I
LamB-
pAJC264
5.7kb
ptac
EcoR I
lacIq
bla
EcoR I
Ligation
BamH I
连接
pSU113
5.9kb
EcoR I BamH I
Acc I
BamH I /BglII
ptac LamB Stx27B LamB
Ligation
BamH I
连接
pSU112
5.9kb
EcoR I
BamH I
BamH I /BglII
ptac LamB StxB LamB
BamH I /AccI
Blunt
Religation
pSU114
5.9kb
EcoR I
Blunt
BamH I /BglII
ptac
LamB
LamB
Stx17B

Figure 1

Joint Venture for Producing Polypeptide, Genetic Engineering Drugs Formed

93P60250C Shanghai WEN HUI BAO in Chinese
4 May 93 p 5

[Article by Ni Dazheng [0242 1129 2973]]

[Summary] The CAS (Chinese Academy of Sciences) Shanghai Institute of Biochemistry has launched a long-term high-level cooperation with Lizhu [7787 3796] Pharmaceutical Group of Zhuhai special economic zone (SEZ) by establishing Zhuhai-Dongfeng Biotechnology Co. Ltd. in Shanghai. The company is to focus on issues of social and economic benefit and expand production of polypeptide drugs, genetic engineering drugs, and diagnostic reagents for marketing. Director of CAS Shanghai branch Wang Zhiqing [3769 1807 0530], Head of the Shanghai Institute of Biochemistry Lin Qishui [2651 0366 6142], and Director of Zhuhai Lizhu Pharmaceutical Group Xu Xiaoxian [1776 1321 0341] signed the agreement.

Performance Testing of Galaxy-II Parallel Supercomputer

93P60265A Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 18, 12 May 93 p 119

[Article by Yuan Guoxing [5913 0948 5281] of the Beijing Institute of Applied Physics and Computational Mathemtics: "Performance Testing of Yinhe-2 (YH-2) Parallel Supercomputer"; cf. JPRS-CST-92-024, 8 Dec 92 p 25 and JPRS-CST-93-001, 7 Jan 93 p 24]

[Text] The YH-2 computer, developed by the Computer Institute at the University of Science and Technology for National Defense (Changsha Institute of Technology), is the nation's first general-purpose 1 billion operations per second (GOPS) parallel supercomputer and represents a major breakthrough for China's general-purpose parallel supercomputing technology. Since the YH-2 supercomputer's development has aroused so much interest lately, we decided to formally test this new supercomputer with IAPCM [? International Association of Personal Computer Manufacturers] benchmarks; in the testing, we took two routines and carried out vectorized and multitasked parallel calculations. Below we list basic indicators and test results for the YH-2 computer.

I. Some Performance Indicators for the YH-2

Master clock speed: 50 MHz.

Word length: 64 bits floating point (FP), 64 bits integer, 32 bits short integer.

Four CPUs, peak speed 400 MFLOPS (64 bits FP), operating system (OS) running at 1 GOPS.

Each CPU has following operating registers:

Vector registers (Vs):

8 64-element Vs, 64 bits/element; output port and input port of each V both can do 1 word/beat.

Scalar registers (Ss):

8 64-bit Ss, read 3 words/beat and write 1 word/beat.

Address registers (As):

8 32-bit-word As, read 3 words/beat and write 1 word/beat.

Local back-up memory (LM):

4 Kwords, 64 bits/word, read/write 1 word/beat, support As, Ss, Vs.

Main memory capacity: 256 Mbytes.

System can be configured with 1 or 2 input/output processors (IOUs), each IOU can form an independent I/O subsystem.

Disk subsystem (DSS): each IOU can articulate 4 intelligent disk controllers (DCUs), each DCU can connect to 8 disk adapters (DADs), each DAD can connect to 2 disk drives (DUs); each DCU can support 8 concurrent DUs; 4 of the DUs under a DCU can operate in a stripping mode to implement software transparency.

Tape subsystem (TSS): each IOU can articulate 2 intelligent tape channel units (TCUs), each TCU can connect to 4 tape controllers (TCs), each TC can connect to 8 tape drives (TDs); each TCU can support 4 concurrent tape streams.

Network system: the YH-2 is articulated into a high-speed fiber optic ring network implementing the FDDI [fiber distributed data interface] network protocol, with a transmission rate of 100 Mbits/s; the YH-2 is also articulated with an Ethernet adapter, for a 10 Mbit/s transmission rate.

Host overall power consumption is about 40 kW.

Host uses short-wind-path, low-temperature, forced-air cooling technology, with an overall cooling power consumption of about 40 kW.

Software systems: OS is a functionally distributed multiprocessor parallel OS; assembly system uses host assembly [language] Y2AL, providing 237 symbolic machine instructions and 50 pseudo-instructions; Fortran compiler system Y2FT.

Multitasking library Y2MTL: macrotasking library, implementing subroutine-level multiprocessor parallel processing; microtasking library, implementing loop-level multiprocessor parallel processing; stack management program; etc.

II. Computation Results

The IAPCM Benchmarks test programs basically test the FP operating speed of various scientific-calculation computer systems with typical FP problems. These programs all use Fortran to make up scalar routines.

We tested the YH-2 with the IAPCM Benchmarks, and for comparison also ran the routines on a VAX11/780 computer. Results are given in the following table:

Results of YH-2 Tested With IAPCM Benchmarks

Routine #	DEC (s) VAX11/780 (s)	YH-2 (s) (automatic vectorization)	VAX11-780	YH-1 (automatic vectorization)	YH-1 (scalar optimized)
			YH-2 (automatic vectorization)	YH-2 (automatic vectorization)	YH-2 (scalar optimized)
1	19375.8	668	29.4	3.7	3.5
2	9283.7	436	21.3	3.8	3.4

Results of YH-2 Tested With IAPCM Benchmarks (Continued)

Routine #	DEC (s) VAX11/780 (s)	YH-2 (s) (automatic vectorization)	VAX11-780	YH-1 (automatic vectorization)	YH-1 (scalar optimized)
			YH-2 (automatic vectorization)	YH-2 (automatic vectorization)	YH-2 (scalar optimized)
3	456.7	41	11.1	3.1	2.5
4	801.5	24.8	32.3	4.0	4.0
5	6939.2	247	28.1	3.2	3.1
6	3766.4	368	10.5	2.9	2.6
7	4290.2	71	60.5	3.3	3.4
8	4771.2	82	58.2	3.2	2.9
9	1720.9	113	15.2	3.8	3.7
10	8449	107	79	2.7	2.7
Average			29.6	3.4	3.2

Noteworthy observations are:

(1) In the above table, YH-2 results are computation results for a single processor.

(2) In the average (i.e. bottom) row, the DUP (data processing) results have been dropped.

The Galaxy parallel supercomputer operates in three parallel modes: vectorized, microtasking, and macrotasking; the parallel OS, compiler system, and Y2MTL support parallel operations for user programs. During our testing of the YH-2, we took two of the routines—YGX and LMTO—in the IAPCM Benchmarks and artificially vectorized and multitasked them, with the following results:

YGX routine:

YH-2 single-processor scalar computation time (CT): 436.0 s.

YH-2 single-processor vector CT: 75.5 s.

YH-2 four-processor vector CT: 28.3 s.

YH-2 vector speedup = YH-2 scalar CT/YH-2 vector CT = 5.7.

YH-2 four-processor parallel speedup = YH-2 single-processor vector CT/YH-2 four-processor vector CT = 2.58.

LMTO routine:

YH-2 single-processor scalar CT: 540.0 s.

YH-2 single-processor vector CT: 148.0 s.

YH-2 four-processor vector CT: 47.0 s.

YH-2 vector speedup: 3.7.

YH-2 four-processor parallel speedup: 3.15.

The results we calculated for the YH-2 computer demonstrate accuracy, precision meeting requirements, and a speed reaching the design value. The YH-2 is the highest-performance domestic computer system so far applied to large-scale scientific and engineering calculations; its development represents a powerful boost to the nation's high technology and parallel computing R&D.

Chinese-English S&T-Materials Machine Translation System Developed

40100089 Beijing CHINA DAILY in English 7 Jun 93 p 3

[Text] Harbin—A university in northeast China's Heilongjiang Province has developed a Chinese-English translating machine for scientific and technological purposes that is among the most advanced in the world. The Chinese-English translating machine has a memory of 25,000 special terms and 20,000 common words. It is also programmed with 2,100 grammatical rules. The accuracy of its translation has reached 78 percent. The machine was developed by the Harbin Polytechnic University and the China Carrier Rocket Research Institute. The machine, named Cemt-III, has been put into use in practical work.

NPU Develops Parallel Programming Environment

93P60254C Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 17, 5 May 93 p 19

[Article by Wen Yuan [2429 0337]: "Parallel Program Design Environment PPE Developed"]

[Summary] Engineers in the Computer Science and Engineering Department of Northwest Polytechnical University [in Xian] have developed a parallel program design environment software package called PPE (parallel programming environment). This software package provides the parallel programmer with full services all the way from source-program editing and compiling to debugging and execution. PPE's operating environment is a multicomputer system consisting of an IBM PC (as a

front-end unit) and a Transputer parallel processing board (as a node unit). PPE is comprised of several tools including a parallel FORTRAN source-program editor, a parallel FORTRAN program symbol debugger, a parallel program compound document automatic generator, and an integrated windows interface.

Shenzhen Firms' Software Export Figures Released

93P60254A Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 17, 5 May 93 p 2

[Article by Xiong Zongyi [3574 1350 6146]: "Shenzhen Software Industry Development Is in the Ascendant"]

[Excerpt] [Passage omitted] Shenzhen's software products were first exported in 1984, but in the past few years development has been faster. In 1990, the Shekou Xinxin Software Co. had 52 varieties of software product exports, earning over US$1 million; in 1992 one Xinxin project alone—the shipping of a [multimedia demonstration] system to the Taiwan Natural Science Museum—represented over US$1 million in foreign exchange. The Wanguo Software Development (Shenzhen) Corp. earned over US$200,000 in its first year of business. The Dashen Data Processing Company's gross export volume for the past few years has reached US$3 million. Finally, the Shenzhen Huada Computer Software Company's software exports are now at an annual output value of US$600,000. [passage omitted]

Hangzhou Institute 52 Develops 21 MB Floptical System

93P60254B Beijing JISUANJI SHIJIE [CHINA COMPUTERWORLD] in Chinese No 17, 5 May 93 p 2

[Article by Pei Xian [1014 0341]: "Hangzhou Institute 52 Develops 21 MB Magneto-Optical Floppy Disk System"]

[Summary] The Ministry of Electronics Industry's Hangzhou Institute 52 (Sikang Magneto-Optical Enterprises subsidiary) recently developed a 21 MB magneto-optical floppy disk (floptical) system. This system uses the model 1325VM 3.5-inch floptical drive made by the U.S. firm INSITE Co. and a 21 MB floppy disk made by the 3M Co., and comes with an independently developed adapter. Formatted memory capacity is 21 MBytes, track density is 1245 TPI [tracks per inch], and bit density is 24,000 BPI [bits per inch]; average track-access time is 65 ms. The system also comes with an SCSI [small computer systems interface], permitting a maximum transmission rate of 1.5 Mbits/s.

Nation's First Million-Pixel CCD Developed by MMEI Institute 44

93P60255A Beijing DIANXIN JISHU [TELECOMMUNICATIONS TECHNOLOGY] in Chinese No 4, Apr 93 p 46

[Untitled, unattributed news brief]

[Text] MMEI's Institute 44 has developed a 1-million-pixel planar array device. This device has the nation's currently highest pixel count and approaches the international standards for planar array 1024 x 1024-pixel high-resolution CCDs. The device acquires a complete frame signal with imaging quality, marking China's entry into a new phase in CCD research. All of the device's dc parameters meet specifications; in particular, transfer efficiency has reached 99.998 percent. Its development can promote [further applications of] CCDs required in such areas as aeronautics, space remote sensing, missile guidance, range tracking, and high-resolution TV. The CCD is one of the most critical semiconductor new high technologies being rapidly developed worldwide, and has broad utilitarian value both for defense and for the civilian economy.

Reports on Photonic Technologies

Modeling Analysis of TIR Semiconductor Optical Switch

93P60256A Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTORS] in Chinese Vol 14 No 4, Apr 93 pp 233-241

[Article by Lin Wenhua [2651 7186 5478] and Zhuang Wanru [8369 1238 1172] of the CAS Institute of Semiconductors, National Integrated Optoelectronics Laboratory (NIOL), Beijing 100083, and Wang Dehuang [3769 1795 3552] of NIOL and the Department of Physics, Beijing University, Beijing 100871: "Modeling Analysis of Total-Internal-Reflection Semiconductor Optical Waveguide Switch"; MS received 4 Nov 91, revised 11 Feb 92]

[Abstract] Optical waveguide switching arrays are key components in optical broadband network switching technologies and in fiber-optic communications systems, as well as basic elements in optoelectronic integrated circuit (OEIC) and photonic integrated circuit (PIC) systems. In this paper, simple and practical modeling of a total-internal-reflection (TIR) waveguide optical switch is carried out. The reflection phenomenon of the guided mode in optical switches with intersecting single-mode waveguides is investigated by wave optics. Numerical results indicating variation in reflectivity, extinction ratio, and reflection loss with waveguide parameters are given. The crosstalk of a TIR optical switch is presented. Various absorption coefficients as a function of TIR switch performance are calculated. The Goos-Haenchen shift under condition of TIR is also discussed.

5 figures, no tables.

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GaAs 3-Waveguide-Coupling Interferometric Modulator

93P60256B Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTORS] in Chinese Vol 14 No 4, Apr 93 pp 247-250

[Article by Feng Hao [7458 3185], Li Huijian [2621 1979 1227], and Wang Minghua [3769 2494 5478] of the Department of Information and Electronic Engineering, Zhejiang University, Hangzhou 310008: "GaAs Three-Waveguide-Coupling Mach-Zehnder Interferometric Intensity Modulator"; MS received 26 Sep 91, revised 25 Dec 91; research supported by grant from the 863 High-Tech Plan and assisted by 863 Plan Optoelectronics Expert Group]

[Abstract] High-speed optical modulators are important devices for optical signal processing, optical communications, and related areas. In this paper, an n^-/n^+ GaAs three-ridge-waveguide-coupling Mach-Zehnder (M-Z) interferometric intensity modulator has been fabricated via vapor phase epitaxy plus chemical etching. The single-mode waveguide has a width of 5 μm, thickness of 2.3 μm, and ridge height of 1.2 μm; coupling waveguide spacing is 3 μm, operating wavelength is 1.15 μm, and 3 dB coupling length is 3.4 mm. Two 3-waveguide-coupling devices are used as 3 dB coupler and M-Z interferometer. An extinction ratio of about -13 dB of the output signal from the center waveguide is obtained with 14V half-wave voltage at 1.15 μm; modulation

depth exceeds 95 percent, 3 dB bandwidth exceeds 1 GHz, and waveguide transmission loss is lower than 0.7 dB/mm.

4 figures, no tables.

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EO Bistability, Tristability in GaAs/GaAlAs SEEDs

93P60256C Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTORS] in Chinese Vol 14 No 4, Apr 93 pp 251-255

[Article by Zhang Yaohui [1728 5069 6540], Jiang Desheng [3068 1795 3932], Li Feng [2621 6912], and Wu Ronghan [0702 2837 3352] of the National Laboratory for Semiconductor Superlattices and Microstructures, CAS Institute of Semiconductors, Beijing 100083, and Zhou Junming [0719 0971 6900] and Mei Xiaobing [2734 4562 0393] of the Laboratory for Molecular Beam Epitaxy (MBE), CAS Institute of Physics, Beijing 100080: "Electro-Optical Bistability, Multistability Effects in GaAs/$Ga_{0.7}Al_{0.3}As$ Short-Period Superlattices"; MS received 2 Jul 92, revised 15 Oct 92; research supported by grant from NSFC]

[Abstract] Bias dependence of photocurrent response near GaAs/$Ga_{0.7}Al_{0.3}As$ (35 Angstrom/35 Angstrom) superlattice absorption edges in domestic-MBE-grown superlattice PIN [positive-intrinsic-negative] diodes at room temperature has been studied. The -1h and -2h exciton transitions induced by Wannier localization produce two regions of negative differential photoconductivity. Photocurrent (absorption) electro-optical (EO) bistability and tristability have been realized in SEEDs [self-electro-optic-effect devices] composed of a superlattice PIN diode and obvious bistable transitions have been observed in unbiased SEEDs.

2 figures, no tables.

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Reports on Picosecond Light Pulse Generation via Semiconductor Lasers

Gain Modulation of Unbiased 1.3-μm InGaAsP Laser

93P60252A Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol A20 No 1, Jan 93 pp 16-20

[Article by Sun Wei [1327 0251], Yi Maobin [5902 5399 2430], Jia Gang [6328 0474], and Gao Dingsan [7559 7844 0005] of the Department of Electronic Science, Jilin University, Changchun 130023: "Ps Light PUlse Generation by Gain Modulation of Unbiased InGaAsP Laser at 1.3 μm"; MS received 8 Apr 91, revised 24 Jul 91]

[Abstract] The kinetics of generating picosecond (ps) light pulses by gain modulation of a semiconductor laser

are analyzed based on nonlinear rate equations. Special double avalanche pulse generators are designed to produce short injection-current pulses. Optical pulses of 15 ps FWHM [full width at half maximum], with a prf of 1 MHz, average power of 3 μW, and corresponding peak power of 200 mW, are obtained by gain modulation of an unbiased InGaAsP/InP buried-crescent diode laser with a room-temperature emission wavelength of 1.3 μm, threshold current of 20 mA, crescent active region thickness of 0.2 μm, width of 2 μm, and cavity length of 200 μm.

Table 1 (not reproduced) lists parameters of the 1.3 μm InGaAsP laser by numerical calculation, while Figures 1-4 (not reproduced) show numerical results of photon densities, carrier densities, and injection current vs. time; a block diagram of the double avalanche generator; a graph of the pulses produced by the generator; and an SHG [single harmonic generation] autocorrelation trace of the optical pulses, respectively.

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1.5-μm Mode-Locked InGaAsP Laser

93P60252B Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol A20 No 2, Feb 93 pp 81-84

[Article by Xie Huanghai [6200 7806 3189], Zhang Weizai [1728 0143 0961], Zhang Lianying [1728 5571 5391], and Fang Zujie [2455 4371 2212] of the CAS Shanghai Institute of Optics and Fine Mechanics (SIOFM), Shanghai 201800: "1.5 μm InGaAsP Mode-Locked Laser Emitting ps Light Pulse"; MS received 29 May 91, revised 10 Jul 91]

[Abstract] Structure and fabrication of a 1.5-μm-wavelength InGaAsP diode laser with a multimode optical fiber external cavity are described. The laser is a double-channel planar buried structure single-transverse-mode double-heterojunction type plated at one end with a 1.5-μm-band antireflective ZrO_2 coating. The multimode fiber external cavity is a multimode graded-index standard silica communications fiber with a core diameter of 50 μm, fiber external diameter of 125 μm, numerical aperture of 0.2, and fiber length of 10.4 cm. Ultrashort light pulses (18.8 ps FWHM) with a mode-locked prf of 960 MHz are obtained with a dc bias current of 54 mA. Measured optical average power under the above conditions is 3.3 mW, while mode-locked peak optical power (peak pulsed power) is 167 mW.

Figures 1-7 (not reproduced) show a schematic of a mode-locked laser with external cavity, output power vs. current, far-field pattern perpendicular to the junction plane, optical spectra of the laser with and without external cavity, mode-locked pulse train at 960 MHz, optical spectrum of the mode-locked laser, and SHG autocorrelation function of a mode-locked pulse at 960 MHz, respectively.

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Low-Temperature Scanning Tunneling Microscope Developed by CAS

93P60263A Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 7 May 93 p 1

[Article by Huang Yong [7806 0516]: "Low-Temperature Scanning Tunneling Microscope Developed"]

[Summary] Beijing, 5 May—Scientists at the CAS Institute of Chemistry and CAS Institute of Physics have jointly developed the nation's first low-temperature scanning tunneling microscope (STM), and have successfully conducted experimental research—yielding high-resolution (atomic level) imagery—at the liquid-nitrogen-temperature surface of monocrystalline bismuth oxide in a bismuth-strontium-calcium-copper oxide compound. This new low-temperature STM, developed under the leadership of CAS Institute of Chemistry Research Fellow Bai Chunli [4101 2504 4409], basically uses domestically made components; the design of the instrument probe, low-temperature control system, signal amplification system, and feedback control system and the automated-control computer data acquisition and image processing/display functions all have their own originality. This instrument's cost-performance ratio has reached international standards.

Relative Refractive Index Variation Spectra of a GaAs Film, Its Effect on Optical Switch Characteristics

40100084A Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol A20 No 2, Feb 93 pp 107-111

[English abstract of article by Wang Dehuang of the Department of Physics, Beijing University, 100871, Semiconductor Institute Region, National Integrated Optoelectronics Laboratories, Beijing; MS received 30 Apr 92, revised 8 Jul 92]

[Text] The relative variation spectra of reflectivity induced by injected carrier in an undoped GaAs film in the 820-900 nm range are measured experimentally. The relative variation spectrum of refractive index are also obtained using above results. The above results' effect on optical switching characteristics are analyzed.

Spectral Properties of YAG : Er, Ce Laser Crystals

40100084B Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol A20 No 2, Feb 93 pp 152-155

[English abstract of article by Yu Yaqin, Wang Qingyuan, and Zhang Siyuan of Changchun Institute of Applied Chemistry, CAS, Changchun 130022; MS received 25 Nov 91, revised 15 Jan 92; research supported by grant from NSFC]

[Text] The spectral properties of YAG double doped with Er^{3+} (at 2 percent), Ce^{3+} (at 0.3 percent) (YAG : Er, Ce) laser crystals grown by Czochralski technique are reported. The absorption and emission spectra have been measured at room temperature. By using absorption spectra and Judd-Ofelt theory, the experimental oscillator strengths have been calculated and are discussed as well.

Ring Self-Pumped Phase Conjugation of Ce-Doped KNSBN Crystals

40100083A Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol A20, No 1, Jan 93 pp 62-66

[English abstract of article by Sun Daliang, Chen Jun, Song Yongyan, Jiang Quanzhong, and Chen Huanchu of the Institute of Crystal Materials, Shandong University, Jinan 250100, and Xu Jingjun, Wu Yuanqing, Liu Simin, and Zhang Guangyin of the Physics Department, Nankai University, Tianjin 300071; MS received 8 Apr 91, research supported by State S&T Commission "863" grant]

[Text] Self-pumped phase conjugation in a-face tilted-cut Ce-doped $(KNa)_{0.1}$ $(Sr_{0.75}Ba_{0.25})_{0.9}$ Nb_2O_6 crystal is demonstrated without external reflection mirrors, pumping beam and applied field, and phase conjugation reflectivities as high as 25 percent are measured. The threshold power is lower than 0.03 W/cm^2. Its photorefractive coupling constant is computed for various a-face tilted-cut angles for the first time.

Calculation of Spectroscopic Parameters of Ho^{3+} in HoP_5O_{14} Noncrystals

40100083B Shanghai ZHONGGUO JIGUANG [CHINESE JOURNAL OF LASERS] in Chinese Vol A20 No 1, Jan 93 pp 67-72

[English abstract of article by Chen Jinkai and Chen Xiaobo of the Experimental Center, Fujian Normal University, Fuzhou 350007, and Liu Yanbin and Li Jiaji of Beijing Institute of Synthetic Crystals, Beijing, China; MS received 12 Mar 91, revised 17 Jun 91]

[Text] Intensity parameters Q_λ of Ho^{3+} in noncrystalline HoP_5O_{14} are calculated with absorption spectrum measurement. Based on these Q_λ values, the oscillator strength, spontaneous radiative rate, branching ratio and integrated emission cross section are estimated. A discussion on the potentiality of application of this infrared laser material is given.

New Type of Far-Infrared Detector Based on Ge_xSi_{1-x}/Si Heterojunction

40100086C Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTORS] in Chinese Vol 14 No 4, Apr 93 pp 260-263

[English abstract of article by Gong Dawei, Yang Xiaoping, Wei Xing, Hu Jihuang, Zhang Xiangjiu, Sheng Chi, and Wang Xun of the National Key Laboratory for Applied Surface Physics, Fudan University, Shanghai 200433, Zheng Guoxiang of the Department of Materials Science, Fudan University, Shanghai 200433, Dong Jianmin, Wu Zuoliang, and Liang Pingzhi of the Shanghai Institute of Technical Physics, CAS, Shanghai 200083; MS received 10 Jul 92, revised 14 Nov 92]

[Text] A Ge_xSi_{1-x}/Si heterojunction infrared detector was fabricated by molecular beam epitaxy (MBE) combined with Si planar technology. The barrier height is no more than 0.09 eV and the photoresponse range may be extended from 2 μm to 12 μm. The blackbody detectivity D^*_{873K} is 2 x 10^8 $cmHz^{1/2}/W$ at temperature of 50K and 6 x 10^8 $cmHz^{1/2}/W$ at 30K. Also at 30K D^*_{500K} is 1.6 x 10^8 $cmHz^{1/2}/W$. Since its photoresponse range is broad, the detector is sensitive to radiation from the human body under a background of 300K though its peak detectivity is still low.

Low-Pressure MOCVD Growth, Characterization of InGaAs/InP Bulk Materials, Quantum Wells, Superlattices

40100086A Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTORS] in Chinese Vol 14 No 4, Apr 93 pp 208-216

[English abstract of article by Zhu Longde, Li Jing, Chen Deyong, and Xiong Feike of the Institute of Semiconductors, CAS, Beijing 100083; MS received 12 Nov 91, revised 11 Jan 92]

[Text] Low-pressure MOCVD growth of InP, InGaAs bulk materials, InGaAs/InP quantum wells and superlattices is investigated. The background electron concentrations of the InP layers were (1-5) x 10^{15} cm^{-3}, and the best 77K electron mobility was 45,240 cm^2/V-s. The strained-lattice mismatch of the InGaAs/InP heterojunction could be controlled within (1-3) x 10^{-3}. The background electron concentrations of the lattice-matched InGaAs were (2-5) x 10^{15} cm^{-3}. Room-temperature and 77K electron mobilities were 8,660 and 65,150 cm^2/V-s, respectively. InGaAs/InP quantum wells with well width ranging from 114 Angstroms to 6.4 Angstroms have been grown. Corresponding energy shift of the photoluminescence (PL) emission peak with respect to the reference layer due to quantum size effect was varied from 59 meV to 362.5 meV, and the spectrum linewidth was increased from 12.4 meV to 57 meV. InGaAs/InP superlattices with well width from 25 Angstroms to 96 Angstroms, barrier width from 88 Angstroms to 240 Angstroms, were grown. Double-crystal X-ray diffraction rocking curves of the superlattices showed satellite peaks up to as high as the third order, demonstrating fairly high quality of the superlattice materials. Preferential incorporation of the residual As into InP grown on InGaAs layer was observed, and the incorporated As fraction was as high as 0.09, which was a factor increasing PL linewidth and decreasing PL energy shift.

Channeling Effect for Low-Energy Si^+ Ion Implantation in GaAs

40100086B Beijing BANDAOTI XUEBAO [CHINESE JOURNAL OF SEMICONDUCTORS] in Chinese Vol 14 No 4, Apr 93 pp 217-223

[English abstract of article by Jiang Bingyao, Shen Honglie, Zhou Zuyao, and Xia Guanqun* of the Ion Beam Laboratory, *Fourth Laboratory, Shanghai Institute of Metallurgy, CAS, Shanghai 200050; MS received 18 Oct 91, revised 20 Dec 91]

[Text] Monte Carlo computer simulations based on the binary collision approximation have been employed to study the channeling effect for low-energy Si^+ ion implantation in GaAs.

Both the range profiles of implanted ions by simulations and measured by SIMS [secondary ion mass spectrometry] confirm that the range profiles are broader and deeper than those for implantation into amorphous GaAs if the incident ion beam is tilted 7° from <100> axis.

Simulations show that a 15° tilt combined with 7° rotation from [curly brace]100[curly brace] plane is an optimum selection for the reduction of the channeling effect, and the depth profiles are quite close to the Gaussian distributions.

Cable Laid for Nation's First Undersea Fiber Optic Line

93P60262A Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 22 May 93 p 2

[Article by Ni Kezhong [0242 0344 0022]: "Nation's First Undersea Fiber Optic Cable Laying Successful"]

[Text] The nation's first low-loss, high-capacity undersea fiber optic communications cable was successfully laid recently by a group of [domestic] units including the Shanghai China Marine Cable Construction Co., MPT's Ship No. 1, and a Navy waterline engineering unit. This cable begins in Guangdong Province, Xuwen County, Santang city, spans the Qiongzhou Straits, and leads directly to Hainan Province, Houhai city. Total length is 22.5 km. Cable and optical terminal equipment were imported from Japan and France, respectively. The new cable can carry 14,400 simultaneous telephone circuits, and will be used for critical wired telecommunications between the mainland and Hainan Island.

Projects To Help Ease Telecom Bottleneck

40100088A Beijing CHINA DAILY (BUSINESS WEEKLY) in English 24 May 93 p 1

[Article by Wang Yong]

[Text] China's largest telecommunications engineering company is thriving on a surging domestic market for optical fibre this year.

In fact, the optical fibre telecommunications market will remain hectic throughout 2000, said Qi Fusheng, president of the China International Telecom Construction Corporation (CITCC).

His company, affiliated to the Ministry of Posts and Telecommunications, shoulders the bulk of the nation's trunk-cable construction.

"Demand for optical fibre will soar as China spruces up its lacklustre telecommunications industry," Qi predicted in an interview with BUSINESS WEEKLY.

Statistics show that the growth of telecommunications has outpaced that of the gross national product by a huge margin.

Qi revealed that his company would participate in the construction of a 3,175-kilometre optical fibre trunk line this year to link Xi'an, capital city of Shaanxi Province, with Urumqi, capital of the Xinjiang Uygur Autonomous Region.

His company alone will be the overall contractor for the 2,200-kilometre stretch from Xi'an to Lanzhou, capital city of Gansu Province.

The whole project, involving a total investment of 640 million yuan ($110 million), is designed to ease the telecommunications bottleneck in China's vast northwest region.

Of the total investment, about $50 million will be used to import foreign equipment.

Qi said the project is expected to be complete by 1995.

Also, construction of an optical fibre trunk line spanning China, the Commonwealth of Independent States and Germany, is expected to begin in the near future.

In September, Qi's company will start building an optical trunk line from Beijing to Harbin.

Qi said the brisk domestic market for optical fibre telecommunications has posed, together with considerable profits, fierce competition for his company.

He revealed that from 1993 on, all the engineering projects in the telecommunications sector would be open to public bidding.

"We have to go upmarket and give full play to our advantages in taking on technology-intensive projects," he said.

He said his company would buy more large equipment, like trench diggers, from overseas in the years to come.

He will lead a corporate delegation to the United States next month for a market survey.

"I hope to sign agreements for such purchases with the US in Beijing later this year," he said.

The advanced machines are suited for projects in North China where land is more level than the south.

Qi believed the imports, which would increase year by year, would give his company a leg up over other domestic engineering rivals.

In another development, CITCC is ready to go overseas for engineering contracting.

Qi disclosed his company will open a branch in Thailand soon this year.

Also, he said his company is negotiating with the US AT&T Company to set up a joint venture, but he said details are not available yet.

Compression Coding Scheme of HDTV Signals With 140 Mb/s Transmission Bit Rate

40100085A Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 21 No 4, Apr 93 pp 64-70

[English abstract of article by Zhang Chuntian and Gao Xin of the Department of Electronic Engineering, Tianjin University, Tianjin 300072; MS received Jun 91, revised Oct 91; research supported by grant from NSFC]

[Text] A new hybrid coding scheme with subsampled DPCM [differential pulse code modulation] and interpolative DPCM is proposed. It may be utilized for 140 Mb/s transmission of HDTV signals without involving high-speed complex processing. Computer simulation

results show that high quality of reconstructed pictures can be obtained by the proposed coding scheme.

Coding Scheme To Transmit HDTV Signals at Bit Rate of 565 Mb/s

40100085B Beijing DIANZI XUEBAO [ACTA ELECTRONICA SINICA] in Chinese Vol 21 No 4, Apr 93 pp 95-97

[English abstract of article by Xiong Qingxu of the Department of Radio Electronics, Beijing University, Beijing 100871; MS received Jun 91, revised Nov 92; research supported by grant from NSFC]

[Text] Different schemes of intrafield prediction coding of HDTV component signals Y, U, V are discussed. According to the "Large Error Criterion," the coding scheme is determined, and two nonlinear quantizers of luminance and chrominance with 16 levels are designed by subjective tests. The subjective tests show that it is difficult to distinguish the reconstructed picture from the original one.

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